# NATURAL RESOURCES MAPPING AND STUDIES OF FLORISITICS AND PHYSIOGNOMY AT FLAG PONDS NATURAL AREA, CALVERT COUNTY, MARYLAND

**Prepared by**
John E. Hench, Ph.D.
4313 Wendy Court
Monrovia, Maryland 21770.

**Submitted to**
David C. Brownlee, Ph.D.
Department of Planning and Zoning
Calvert County Court House
Prince Frederick, Maryland 20678

**December 24, 1990**

## CONTRACT SYNOPSIS

This report was prepared to satisfy the requirements of the proposal (Attachment A) submitted to the Calvert County Department of Planning and Zoning on May 8, 1990. As stated in the proposal, the goal and objectives of the project were:

### Goal

To acquire natural resources data necessary to objectively access impacts of development in Flag Ponds Natural Area, Calvert County, Maryland.

### Objectives

To prepare 1" = 200' scale natural resource plates for Flag Ponds Natural Area including (1) topography with existing development, (2) soils, (3) slope, (4) wetlands, (5) 100 year floodplain and drainage, (6) black-and-white leaf-on and leaf-off aerial photography, and (7) major plant communities.

To describe the floristics and physiognomy of major plant communities at Flag Ponds Natural Area.

To establish a permanent plot system at Flag Ponds Natural Area.

## METHODOLOGY

Methods for preparing natural resource plates and describing floristics and physiognomy are described in the proposal (Attachment A).

## SUMMARY OF RESULTS AND FINDS

### Natural Resource Plates

The following prime source material, at a scale of 1" = 200', was obtained for use in preparing the natural resource plates:

1. Soils,
2. U.S. Fish and Wildlife Service, National Wetlands Inventory wetlands,
3. Black-and-white leaf-on aerial photography dated March 1990,
4. Black-and-white leaf-off aerial photography dated August 1988.

Using the prime source information, the original base map for the park, and results of the survey of floristics and physiognomy, the following natural resource plates were prepared:

1. Park base map with neat line, map title, scale, and north arrow,
2. Slope,
3. Composite map showing major soil groups (upland, alluvial, unclassified, and coastal), vegetation/habitat types, and water regime,
4. Locations of permanent plots,
5. Direction of major drainage and approximate 100 year floodplain.

## Descriptions of Floristics and Physiognomy

A total of 136 man-hours were spent setting-up and inventorying 30 permanent plots (Table 1). During the field work 53 herbaceous species were noted (Table 2). Of these, 13 were identified only to genus because they were not flowering during the site visits. Two species, Aster sagittifolius and Lemna trisulca, are considered by the Maryland Department of Natural Resources, Forest, Park and Wildlife Service, Maryland Natural Heritage Program, as highly rare in Maryland. The latter species is also listed as State Endangered. Aster sagittifolius occured on plot J-10 in strata B whereas Lemna trisulca occured on plots G-2, G-4, H-3, H-4, I-5, J-7, and J-8 in strata A. Frequency (%) [$100m_i/n$ where m = total number of plots on which the ith species occurs, and n = total number of plots sampled (15)] and relative frequency (%) [$100m_i/\Sigma m_i$] for each herbaceous species are presented by strata [A = elevations < 7.62 meters; B = elevations > 7.62 meters] in Table 3.

A total of 50 species of trees [a woody stem > 6.4 meters tall], shrubs [a woody stem or stems < 6.4 meters tall], and vines were noted during the plant inventory (Table 4). Density (number/hectare) [$y/an$ where $y$ = shrubs tallied for the ith species on n plots; a = plot area in hectares (0.0016 hectares); n = total number of plots sampled (15)], relative density (%) [$100y_i/\Sigma y_i$], and importance value [relative frequency + relative density/2] are presented by strata for shrubs in Table 5. Basal area (meters square/hectare) [$Fx_i/n$ where F = 2 meters square/hectare; $x_i$ = trees tallied for the ith species on n points; n = total number of points sampled (15)], relative basal area (%) [$100x_i/\Sigma x_i$], density (number/hectare) [$y_i/an$ where $y_i$ = trees tallied for the ith species on n plots; a = plot area in hectares (.031416)], relative density (%), frequency (%), relative frequency (%), importance value (%) [relative basal area + relative density + relative frequency/3], and quadratic average average diameter breast height (centimeters) [$\sqrt{4R^2Fx_i/y_i}$ where R = 10 meters] are presented for trees by strata in Table 6. Also

Table 1.
Permanent plot coordinates, strata occupied (A= lowland, B= upland, see text), and dates established at Flag Ponds, Calvert County, Maryland, 1990.

| Plot Number | Strata | Date Established |
|---|---|---|
| B-5 | B | 11 May |
| C-5 | B | " |
| C-6 | B | " |
| E-5 | B | 23 Apr |
| E-6 | B | " |
| F-3 | B | 24 Apr |
| F-4 | B | 23 Apr |
| F-5 | B | " |
| G-2 | A | 2 Jun |
| G-4 | A | " |
| H-3 | A | " |
| H-4 | A | " |
| H-7 | B | 23 Apr |
| H-8 | B | " |
| H-9 | B | " |
| H-10 | B | " |
| I-5 | A | 11 May |
| I-6 | A | " |
| I-7 | A | " |
| I-8 | B | 23 Apr |
| I-10 | B | 24 Apr |
| J-5 | A | 11 May |
| J-7 | A | 2 Jun |
| J-8 | A | " |
| J-10 | B | 24 Apr |
| K-6 | A | 11 May |
| K-7 | A | 2 Jun |
| K-8 | A | 1 Jun |
| K-9 | A | " |
| L-9 | A | 9 Sep |

Table 2.
List of herbaceous plants inventoried on permanent plots, Flag Ponds Nature Park, Calvert County, Maryland, 1990.

| Latin Name | Common Name |
|---|---|
| Allium sp. | Wild Garlic |
| Ammophila breviligulata | American beachgrass |
| Arisaema sp. | Indian Turnip |
| Arisaema atrorubens | Jack-in-the-pulpit |
| Arisaema triphyllum | Jack-in-the-pulpit |
| Aster sp. | Aster |
| Aster sagittifolius | Arrow-leaved Aster |
| Athyrium platyneuron | Ebony spleenwort |
| Caltha palustris | Marsh marigold |
| Carex sp. | Sedge |
| Cenchrus tribuloides | Dune sandbur |
| Ceratophyllum demersum | Honewort |
| Cryptotaenia canadensis | Wild chervil |
| Dentaria diphylla | Two-leaved toothwort |
| Desmodium nudiflorum | Naked-leaved tick-trefoil |
| Digitaria sp. | Crabgrass |
| Diodia teres | Rough buttonweed |
| Equisetum sp. | Scouring rush |
| Erigeron canadensis | Horseweed |
| Eupatorium sp. | Thoroughwort |
| Euphorbia maculata | Eyebane |
| Fragaria virginiana | Wild strawberry |
| Galearis spectabilis | Showy orchis |
| Galium sp. | Cleavers bedstraw |
| Galium circaezans | Wild licorice |
| Hibiscus moscheutos | Rose mallow |
| Impatiens capensis | Spotted touch-me-not |
| Lathyrus japonicus | Beach pea |
| Lemna sp. | Duckweed |
| Lemna minor | Smaller duckweed |
| Lemna trisulca | Star duckweed |
| Lycopodium obscurum | Groundpine |
| Menispermum canadense | Canada moonseed |
| Mitchella repens | Twin-berry |
| Oxalis sp. | Wood-sorrel |
| Phragmites australis | Wild reed |
| Podophyllum peltatum | May-apple |
| Polygonum persicaria | Lady's thumb |
| Polystichum acrostichoides | Christmas fern |
| Ranunculus sp. | Buttercup |
| Ranunculus arbortivus | Kidney-leaved Crowfoot |
| Ranunculus septentrionalis | Swamp buttercup |
| Saururus cernuus | Water dragon |
| Scirpus sp. | Bulrush |
| Sporobolus sp. | Dropseed |
| Symplocarpus foetidus | Skunk cabbage |
| Tovara virginiana | Virginia knotweed |
| Typha angustifolia | Narrow-leaved cat-tail |
| Typha latifolia | Common cat-tail |
| Viola sp. | Violet |

Table 2. Continued.

| | |
|---|---|
| Viola conspera | American dog violet |
| Viola rotundifolia | Round-leaved yellow violet |
| Xanthium sp. | Cocklebur |

Table 3.

| Herbaceous Species | Strata | Freq. (%) | Rel. Freq. (%) |
|---|---|---|---|
| Allium sp. | A | 6.67 | 2.27 |
| | B | - | - |
| Ammophila breviligulata | A | 6.67 | 2.27 |
| | B | - | - |
| Arisaema sp. | A | - | - |
| | B | 33.33 | 6.02 |
| Arisaema atrorubens | A | - | - |
| | B | 6.67 | 1.2 |
| Arisaema triphyllum | A | - | - |
| | B | 6.67 | 1.2 |
| Aster sp. | A | - | - |
| | B | 53.33 | 9.64 |
| Aster sagittifolius | A | - | - |
| | B | 6.67 | 1.2 |
| Athyrium platyneuron | A | - | - |
| | B | 6.67 | 1.2 |
| Caltha palustris | A | 6.67 | 2.27 |
| | B | 6.67 | 1.2 |
| Carex sp. | A | 6.67 | 2.27 |
| | B | 6.67 | 1.2 |
| Cenchrus tribuloides | A | 6.67 | 2.27 |
| | B | - | - |
| Ceratophyllum demersum | A | - | - |
| | B | 6.67 | 1.2 |
| Cryptotaenia canadensis | A | - | - |
| | B | 6.67 | 1.2 |
| Dentaria diphylla | A | - | - |
| | B | 20 | 3.61 |

Table 3. Continued.

| Herbaceous Species | Strata | Freq. (%) | Rel. Freq. (%) |
|---|---|---|---|
| Desmodium | A | - | - |
| nudiflorum | B | 13.33 | 2.41 |
| Digitaria | A | 6.67 | 2.27 |
| sp. | B | - | - |
| Diodia | A | 6.67 | 2.27 |
| teres | B | - | - |
| Equisetum | A | - | - |
| sp. | B | 6.67 | 1.2 |
| Erigeron | A | 6.67 | 2.27 |
| canadensis | B | - | - |
| Eupatorium | A | 6.67 | 2.27 |
| sp. | B | 6.67 | 1.2 |
| Euphorbia | A | 6.67 | 2.27 |
| maculata | B | - | - |
| Fragaria | A | - | - |
| virginiana | B | 13.33 | 2.41 |
| Galearis | A | - | - |
| spectabilis | B | 6.67 | 1.2 |
| Galium | A | 13.33 | 4.54 |
| sp. | B | 33.33 | 6.02 |
| Galium | A | - | - |
| circaezans | B | 26.67 | 4.82 |
| Hibiscus | A | 33.33 | 11.36 |
| moscheutos | B | - | - |
| Impatiens | A | - | - |
| capensis | B | 13.33 | 2.41 |
| Lathyrus | A | 6.67 | 2.27 |
| japonicus | B | - | - |

Table 3. Continued.

| Herbaceous Species | Strata | Freq. (%) | Rel. Freq. (%) |
|---|---|---|---|
| Lemna sp. | A | 20 | 6.82 |
| | B | - | - |
| Lemna minor | A | 6.67 | 2.27 |
| | B | - | - |
| Lemna trisulca | A | 46.67 | 15.9 |
| | B | - | - |
| Lycopodium obscurum | A | - | - |
| | B | 6.67 | 1.2 |
| Menispermum canadense | A | 6.67 | 2.27 |
| | B | - | - |
| Mitchella repens | A | 26.67 | 9.09 |
| | B | 6.67 | 1.2 |
| Oxalis sp. | A | - | - |
| | B | 6.67 | 1.2 |
| Phragmites australis | A | 13.33 | 4.54 |
| | B | - | - |
| Podophyllum peltatum | A | - | - |
| | B | 33.33 | 6.02 |
| Polygonum persicaria | A | - | - |
| | B | 6.67 | 1.2 |
| Polystichum acrostichoides | A | - | - |
| | B | 26.67 | 4.82 |
| Ranunculus sp. | A | - | - |
| | B | 20 | 3.61 |
| Ranunculus abortivus | A | - | - |
| | B | 20 | 3.61 |

Table 3. Continued.

| Herbaceous Species | Strata | Freq. (%) | Rel. Freq. (%) |
|---|---|---|---|
| Ranunculus septentrionalis | A | - | - |
| | B | 6.67 | 1.2 |
| Saururus cernuus | A | - | - |
| | B | 13.33 | 2.41 |
| Scirpus sp. | A | 6.67 | 2.27 |
| | B | - | - |
| Sporobolus sp. | A | 6.67 | 2.27 |
| | B | - | - |
| Symplocarpus foetidus | A | - | - |
| | B | 13.33 | 2.41 |
| Tovara virginiana | A | - | - |
| | B | 13.33 | 2.41 |
| Typha angustifolia | A | 20 | 6.82 |
| | B | - | - |
| Typha latifolia | A | 6.67 | 2.27 |
| | B | - | - |
| Viola sp. | A | 6.67 | 2.27 |
| | B | 46.67 | 8.43 |
| Viola conspera | A | - | - |
| | B | 20 | 3.61 |
| Viola rotundifolia | A | - | - |
| | B | 6.67 | 1.2 |
| Xanthium sp. | A | 6.67 | 2.27 |
| | B | - | - |

Table 4.

List of trees, shrubs and vines inventoried on permanent plots at Flag Ponds Nature Park, Calvert County, Maryland, 1990.

| Latin Name | Common Name |
|---|---|
| Acer rubrum | Red Maple |
| Amelanchier sp. | Shadbush |
| Asimina triloba | Pawpaw |
| Campsis radicans | Trumpet Creeper |
| Carpinus carolinia | American hornbeam |
| Carya glabra | Pignut hickory |
| Cephalanthus occidentalis | Button bush |
| Cornus florida | Flowering dogwood |
| Cornus stolonifera | Red osier |
| Diospyros virginiana | Common persimmon |
| Euonymus americanus | Strawberry bush |
| Fagus grandifolia | Beech |
| Fraxinus pennsylvanica | Green ash |
| Ilex opaca | American holly |
| Ilex verticillata | Black alder |
| Juniperus virginiana | Red cedar |
| Kalmia latifolia | Mountain laurel |
| Lindera benzoin | Spicebush |
| Liquidambar styraciflua | Sweet gum |
| Liriodendron tulipifera | Tulip tree |
| Lonicera japonica | Japanese honeysuckle |
| Myrica cerifera | Wax-myrtle |
| Nyssa sylvatica | Black gum |
| Ostrya virginiana | Ironwood |
| Parthenocissus quinquefolia | Virginia Creeper |
| Pinus rigida | Pitch pine |
| Pinus taeda | Loblolly pine |
| Pinus virginiana | Virginia Pine |
| Platanus occidentalis | Sycamore |
| Prunus serotina | Black cherry |
| Prunus virginiana | Choke Cherry |
| Quercus sp. | Oak |
| Quercus alba | White oak |
| Quercus falcata | Spanish oak |
| Quercus marylandica | Black jack oak |
| Quercus phellos | Willow oak |
| Quercus prinus | Chestnut oak |
| Quercus rubra | Red oak |
| Rhus copallina | Dwarf sumac |
| Rhus radicans | Poison ivy |
| Robinia pseudo-acacia | Black locust |
| Salix nigra | Black willow |
| Sambucus canadensis | Common elder |
| Sassafrass albidum | Sassafrass |
| Smilax rotundifolia | Common greenbrier |
| Ulmus americana | American elm |
| Vaccinium corymbosum | Highbush blueberry |
| Viburnum acerifolium | Maple-leaved viburnum |
| Viburnum prunifolium | Blackhaw |
| Vitis sp. | Grape |

Table 5.

| Woody Species <7m tall | Strata | Density (#/ha) | Rel. Density (%) | Freq. (%) | Rel. Freq. (%) | Importance Value % |
|---|---|---|---|---|---|---|
| Acer rubrum | A | - | - | - | - | - |
| | B | 6666.33 | 8.64 | 46.67 | 7.29 | 7.96 |
| Amelanchior sp. | A | - | - | - | - | - |
| | B | 1000 | 1.36 | 13.33 | 2.08 | 1.72 |
| Asimina triloba | A | 500 | 2.56 | 6.67 | 3.03 | 2.8 |
| | B | 12333.33 | 16.82 | 66.67 | 10.42 | 13.62 |
| Campsis radicans | A | 1666.67 | 8.55 | 13.33 | 6.06 | 7.31 |
| | B | - | - | - | - | - |
| Carpinus caroliniana | A | - | - | - | - | - |
| | B | 11333.33 | 15.45 | 40 | 6.25 | 10.85 |
| Carya sp. | A | - | - | - | - | - |
| | B | 500 | 0.68 | 20 | 3.13 | 1.91 |
| Carya glabra | A | - | - | - | - | - |
| | B | 2333.33 | 3.18 | 40 | 6.25 | 4.72 |
| Cephalanthus occidentalis | A | 1166.67 | 5.98 | 13.33 | 6.06 | 6.02 |
| | B | - | - | - | - | - |
| Cornus florida | A | - | - | - | - | - |
| | B | 2833.33 | 3.86 | 40 | 6.25 | 5.06 |
| Cornus stolonifera | A | 1000 | 5.13 | 6.67 | 3.03 | 4.08 |
| | B | - | - | - | - | - |
| Diospyros virginiana | A | 166.67 | 0.85 | 6.67 | 3.03 | 1.94 |
| | B | - | - | - | - | - |
| Euonymus americanus | A | 833.33 | 4.27 | 6.67 | 3.03 | 3.65 |
| | B | 1833.33 | 2.5 | 6.67 | 1.04 | 1.77 |
| Fagus grandifolia | A | 333.33 | 1.71 | 13.33 | 6.06 | 3.88 |
| | B | 1333.33 | 1.82 | 20 | 3.13 | 2.47 |
| Fraxinus pennsylvanica | A | 2333.33 | 11.96 | 26.67 | 12.12 | 12.04 |
| | B | - | - | - | - | - |

Table 5. Continued.

| Woody Species <7m tall | Strata | Density (#/ha) | Rel. Density (%) | Freq. (%) | Rel. Freq. (%) | Importance Value % |
|---|---|---|---|---|---|---|
| Ilex opaca | A | - | - | - | - | - |
| | B | 7666.67 | 10.45 | 80 | 12.5 | 11.48 |
| Ilex verticillata | A | 2500 | 12.82 | 6.67 | 3.03 | 7.92 |
| | B | - | - | - | - | - |
| Juniperus virginiana | A | 166.67 | 0.85 | 6.67 | 3.03 | 1.94 |
| | B | - | - | - | - | - |
| Kalmia latifolia | A | - | - | - | - | - |
| | B | 333.33 | 0.45 | 6.67 | 1.04 | 0.75 |
| Lindera benzoin | A | 333.33 | 1.71 | 6.67 | 3.03 | 2.37 |
| | B | 8166.67 | 11.14 | 33.33 | 5.21 | 8.17 |
| Liquidambar styraciflua | A | 1666.67 | 8.55 | 13.33 | 6.06 | 7.31 |
| | B | 333.33 | 0.45 | 6.67 | 1.04 | 0.75 |
| Myrica cerifera | A | 3666.67 | 18.8 | 20 | 9.09 | 13.95 |
| | B | - | - | - | - | - |
| Nyssa sylvatica | A | 166.67 | 0.85 | 6.67 | 3.03 | 1.94 |
| | B | - | - | - | - | - |
| Ostrya virginiana | A | - | - | - | - | - |
| | B | 166.67 | 0.23 | 6.67 | 1.04 | 0.63 |
| Parthenocissus quinquefolia | A | - | - | 6.67 | 1.04 | - |
| | B | 666.67 | 0.91 | 13.33 | 2.08 | 1.5 |
| Pinus taeda | A | 166.67 | 0.85 | 6.67 | 3.03 | 1.94 |
| | B | - | - | - | - | - |
| Prunus serotina | A | 666.67 | 3.42 | 6.67 | 3.03 | 3.22 |
| | B | - | - | - | - | - |
| Prunus virginiana | A | - | - | - | - | - |
| | B | 5166.67 | 7.04 | 66.67 | 10.42 | 8.73 |
| Quercus sp. | A | - | - | - | - | - |
| | B | 166.67 | 0.23 | 6.67 | 1.04 | 0.63 |
| Quercus alba | A | - | - | - | - | - |
| | B | 166.67 | 0.23 | 6.67 | 1.04 | 0.63 |

Table 5. Continued.

| Woody Species <7m tall | Strata | Density (#/ha) | Rel. Density (%) | Freq. (%) | Rel. Freq. (%) | Importance Value % |
|---|---|---|---|---|---|---|
| Quercus falcata | A | 166.67 | 0.85 | 6.67 | 3.03 | 1.94 |
| | B | 166.67 | 0.23 | 6.67 | 1.04 | 0.63 |
| Quercus marilandica | A | 333.33 | 1.71 | 6.67 | 3.03 | 2.37 |
| | B | - | - | - | - | - |
| Quercus prinus | A | - | - | - | - | - |
| | B | 500 | 0.68 | 13.33 | 2.08 | 1.38 |
| Quercus rubra | A | - | - | - | - | - |
| | B | 166.67 | 0.23 | 6.67 | 1.04 | 0.63 |
| Rhus copallina | A | 166.67 | 0.85 | 6.67 | 3.03 | 1.94 |
| | B | - | - | - | - | - |
| Rhus radicans | A | - | - | 6.67 | 3.03 | - |
| | B | 1000 | 1.36 | 13.33 | 2.08 | 1.72 |
| Salix nigra | A | 500 | 2.56 | 6.67 | 3.03 | 2.79 |
| | B | - | - | - | - | - |
| Sassafrass albidum | A | - | - | - | - | - |
| | B | 333.33 | 0.45 | 13.33 | 2.08 | 1.27 |
| Smilax rotundifolia | A | - | - | - | - | - |
| | B | 5666.67 | 7.72 | 33.33 | 5.21 | 6.46 |
| Ulmus americana | A | 333.33 | 1.71 | 13.33 | 6.06 | 3.88 |
| | B | - | - | - | - | - |
| Vaccinium corumbosum | A | - | - | - | - | - |
| | B | 166.67 | 0.23 | 6.67 | 1.04 | 0.63 |
| Viburnum acerifolium | A | - | - | - | - | - |
| | B | 2500 | 3.4 | 33.33 | 5.21 | 4.31 |
| Viburnum prunifolium | A | 166.67 | 0.85 | 6.67 | 3.03 | 1.94 |
| | B | 166.67 | 0.23 | 6.67 | 1.04 | 0.63 |
| Vitis sp. | A | 500 | 2.56 | 6.67 | 3.03 | 2.79 |
| | B | - | - | - | - | - |
| Stand | A | 19500 | | | | |
| | B | 73330.33 | | | | |

Table 6.

| Woody Species >7m tall | Strata | Basal Area (m/ha) | Rel. B.A. (%) | Density (#/ha) | Rel, Density (%) | Freq. (%) | Rel. Freq. (%) | Importance Value (%) | Avg. D.B.H. (CM) |
|---|---|---|---|---|---|---|---|---|---|
| Acer rubrum | A | 2.4 | 19.15 | 89.13 | 27.81 | 40 | 18.75 | 21.9 | 18.51 |
| | B | 1.47 | 4.81 | 48.81 | 7.52 | 53.33 | 8.69 | 7.01 | 24.47 |
| Asimina triloba | A | - | - | - | - | - | - | - | - |
| | B | 0.13 | 0.44 | 2.12 | 0.33 | 6.67 | 1.09 | 0.62 | - |
| Carpinus caroliniana | A | - | - | - | - | - | - | - | - |
| | B | 0.4 | 1.31 | 91.24 | 14.05 | 66.67 | 10.87 | 8.74 | 7.47 |
| Carya glabra | A | - | - | - | - | - | - | - | - |
| | B | 0.26 | 0.85 | 4.24 | 0.65 | 6.67 | 1.09 | 0.86 | 28.28 |
| Cornus florida | A | - | - | 2.12 | 0.66 | 6.66 | 3.13 | 1.26 | - |
| | B | 0.67 | 2.19 | 89.13 | 13.73 | 66.67 | 10.87 | 8.93 | 10.28 |
| Diospyros virginiana | A | - | - | - | - | - | - | - | - |
| | B | 0.13 | 0.43 | 10.61 | 1.63 | 6.67 | 1.09 | 1.05 | 4 |
| Fagus grandifolia | A | - | - | - | - | - | - | - | - |
| | B | 1.07 | 3.5 | 31.83 | 4.9 | 46.67 | 7.61 | 5.34 | 20.65 |
| Fraxinus pennsylvanica | A | 4.53 | 36.15 | 89.13 | 27.81 | 40 | 18.75 | 27.57 | 25.44 |
| | B | 2.93 | 9.59 | 48.81 | 7.52 | 20 | 3.26 | 6.79 | 27.66 |
| Ilex opaca | A | - | - | - | - | - | - | - | - |
| | B | 0.93 | 3.05 | 67.9 | 10.46 | 33.33 | 5.43 | 6.31 | 13.23 |
| Liquidambar styraciflua | A | 3.33 | 26.58 | 76.39 | 23.84 | 53.33 | 25 | 25.14 | 23.57 |
| | B | 4.27 | 13.99 | 127.32 | 19.61 | 93.33 | 15.22 | 16.27 | 20.66 |
| Liriodendron tulipifera | A | - | - | - | - | - | - | - | - |
| | B | 11.2 | 36.68 | 74.27 | 11.44 | 73.33 | 11.69 | 20.03 | 43.81 |
| Nyssa sylvatica | A | 0.13 | 1.04 | 14.85 | 4.63 | 26.67 | 12.5 | 6.06 | 10.69 |
| | B | 0.27 | 0.88 | 6.37 | 0.98 | 20 | 3.26 | 1.71 | 23.09 |
| Ostrya virginiana | A | - | - | - | - | - | - | - | - |
| | B | - | - | 2.12 | 0.33 | 6.67 | 1.09 | 0.47 | - |
| Pinus rigida | A | 1.33 | 10.61 | 14.85 | 4.63 | 13.33 | 6.25 | 7.16 | 23.09 |
| | B | - | - | - | - | - | - | - | - |

Table 6. Continued.

| Woody Species >7m tall | Strata | Basal Area (m/ha) | Rel. B.A. (%) | Density (#/ha) | Rel. Density (%) | Freq. (%) | Rel. Freq. (%) | Importance Value (%) | Avg. D.B.H. (CM) |
|---|---|---|---|---|---|---|---|---|---|
| Pinus taeda | A | 1.2 | 9.58 | 21.22 | 6.62 | 20 | 9.38 | 8.53 | 26.83 |
| | B | 1.07 | 3.5 | 6.37 | 0.98 | 13.33 | 2.17 | 2.22 | 46.19 |
| Pinus virginiana | A | - | - | - | - | - | - | - | - |
| | B | 0.53 | 1.73 | 4.24 | 0.65 | 13.33 | 2.17 | 1.52 | - |
| Platanus occidentalis | A | 0.13 | 1.06 | - | - | - | - | 0.35 | - |
| | B | - | - | - | - | - | - | - | - |
| Prunus virginiana | A | - | - | - | - | - | - | - | - |
| | B | 0.93 | 3.05 | 12.73 | 1.96 | 33.33 | 5.43 | 3.48 | 30.55 |
| Quercus alba | A | - | - | - | - | - | - | - | - |
| | B | 0.13 | 0.43 | 2.12 | 0.33 | 6.67 | 1.09 | 0.62 | - |
| Quercus falcata | A | - | - | - | - | - | - | - | - |
| | B | 2.4 | 7.86 | 4.24 | 0.65 | 6.67 | 1.09 | 3.2 | 40 |
| Quercus marilandica | A | 0.13 | 1.06 | - | - | - | - | 0.35 | - |
| | B | - | - | - | - | - | - | - | - |
| Quercus prinus | A | - | - | - | - | - | - | - | - |
| | B | 0.53 | 0.33 | 2.12 | 0.33 | 6.67 | 1.09 | 1.05 | 56.57 |
| Quercus rubra | A | - | - | - | - | - | - | - | - |
| | B | 0.93 | 3.05 | 2.12 | 0.33 | 6.67 | 1.09 | 1.49 | 74.83 |
| Robinia pseudo-acacia | A | - | - | - | - | - | - | - | - |
| | B | - | - | 2.12 | 0.33 | 6.67 | 1.09 | 0.47 | - |
| Salix nigra | A | 0.13 | 1.06 | 10.61 | 3.31 | 6.66 | 3.13 | 2.5 | 12.65 |
| | B | - | - | - | - | - | - | - | - |
| Sassafrass albidum | A | | | | | | | | |
| | B | 0.13 | 4.26 | 4.24 | 0.65 | 13.33 | 2.17 | 2.36 | 20 |
| Ulmus americana | A | - | - | 5.03 | 1.57 | 6.66 | 3.13 | 1.57 | - |
| | B | - | - | 4.24 | 0.65 | 6.67 | 1.09 | 0.58 | - |
| Stand | A | 12.53 | | 320.43 | | | | | 22.32 |
| | B | 30.53 | | 649.35 | | | | | 24.47 |

included therein are stand basal area [$F\Sigma x_i/n$], stand density [$\Sigma y_i/an$], and stand quadratic average diameter at breast height [$\sqrt{4R^2\Sigma x_i/\Sigma y_i}$].

Ten additional plant species were observed off of the permanent plots during the inventory. These species are given in Table 7. Seven species of amphibians, six species of reptiles, 30 species of birds, and seven species of mammals were also observed. Amphibians and reptiles are listed in Table 8 whereas birds and mammals are listed in Tables 9 and 10, respectively. Of these, Accipiter striatus and Haliaeetus leucocephalus (Table 9) are considered rare in Maryland. The latter species is also listed as State Endangered and Federal Endangered.

## Conclusions

The information presented herein, coupled with the natural resource plates, should allow staff in the Department of Planning and Zoning and the Division of Natural Resources to objectively evaluate some of the effects of future land-use changes at Flag Ponds Natural Area. However, the results of some additional work would be useful. The proposed work includes:

1. Future visits to plot J-10 during the 1991 growing season to verify the presence of Aster sagittifolius.

2. Additional standardized plant inventory work within strata A and B. These data would allow for the statistical differentiation of plant communities and subsquent mapping of plant community boundaries. The natural resource plate depicting vegetation/habitat types illustrates gross physiognomy which may not correlate well with floristic differences between communities.

3. An effort should be made to evaluate the effects of future development in the park on forest interior bird species. These species include Empidponax virescens, Vireo olivaceus, Mniotilta varia, Parula americana, Seiurus motacilla, Seiurus aurocapillus, Oporornis formosus, and Piranga olivacea. Forest interior bird species are negatively affected by forest fragmentation and the creation of edge habitat.

4. Using the park base map, soils map, U.S. Fish and Wildlife Service National Wetlands Inventory map, and aerial photography, an effort should be made to develop a quantitative history of beach erosion just south of Long Beach. It appears as though structures intalled to protect shoreline property in Long Beach are causing accelerated erosion of the park's northernmost shoreline.

Table 7.

Additional herbaceous plants observed at Flag Ponds, Calvert County, Maryland, 1990, that were not located on permanent plots.

| Latin Name | Common Name |
|---|---|
| Maianthemum canadense | Two-leaved solomon's seal |
| Sanguinaria canadensis | Bloodroot |
| Botrychium sp. | Moonwort |
| Aquilegia canadensis | Wild columbine |
| Peltandra virginica | Arrow-arum |
| Althea officinalis | Marshmallow |
| Cypripedium acaule | Pink lady's-slipper |
| Monarda sp. | Horsemint |
| Chenopodium album | Lamb's quarters |
| Epigaea repens | Trailing arbutus |
| | unidentified grasses |
| | unidentified mosses |

Table 8.

List of amphibians and reptiles observed at Flag Ponds, Calvert County, Maryland, 1990. Additional species observed between 1985-1989 are indicated by *.

| Latin Name | Common Name | Strata |
|---|---|---|
| Amphibians | | |
| Ambystoma maculata | Spotted salamander | A |
| Hyla cinerea | Green tree frog | A |
| Hyla crucifer | Spring peeper | B |
| Hyla chrysoscelis | Gray tree frog | B |
| Pseudacris triseriata feriarum | Upland chorus frog | A |
| Rana catesbeiana | Bull frog | A |
| Rana utricularia | Southern leopard frog | A |
| Reptiles | | |
| Agkistrodon contortrix | Northern Copperhead | A* |
| Chelydra serpentina | Common Snapping Turtle | A |
| Cnemidophorus sexlineatus | Six-lined Race Runner | A |
| Eumeces laticeps | Five-lined Skink | A |
| Scincella lateralis | Ground Skink | A* |
| Terrapene carolina | Eastern Box Turtle | A,B |

Table 9.

List of birds observed at Flag Ponds, Calvert County, Maryland, 1990.

| Latin Name | Common Name | Strata |
|---|---|---|
| Accipiter striatus | Sharp-shinned hawk | B |
| Pandion haliaetus | Osprey | A |
| Haliaeetus leucocephalus | Bald eagle | A |
| Anas platyrhynchos | Mallard | A |
| Ardea herodias | Great blue heron | A |
| Butorides striatus | Green-backed heron | A |
| Meleagris gallopavo | Wild turkey | A,B |
| Charadrius vociferus | Killdeer | A |
| Archilochus colubris | Ruby-throated hummingbird | B |
| Melanerpes carolinus | Red-bellied woodpecker | B |
| Empidponax virescens | Acadian flycatcher | A |
| Contopus virens | Eastern Wood-peewee | A,B |
| Progne subis | Purple Martin | A |
| Corvus ossifragus | Fish crow | A |
| Parus carolinensis | Carolina chickadee | B |
| Parus bicolor | Tufted titmouse | B |
| Thryothorus ludovicianus | Carolina wren | B |
| Polioptila caerulea | Blue-gray gnatcatcher | A,B |
| Vireo griseus | White-eyed vireo | A |
| Vireo olivaceus | Red-eyed vireo | A,B |
| Mniotilta varia | Black-and-white warbler | B |
| Parula americana | Northern parula | A,B |
| Dendroica pinus | Pine warbler | A,B |
| Seiurus motacilla | Louisiana waterthrush | B |
| Seiurus aurocapillus | Ovenbird | B |
| Oporornis formosus | Kentucky warbler | B |
| Agelaius phoeniceus | Red-winged blackbird | A |
| Quiscalus quiscula | Common grackle | A |
| Piranga olivacea | Scarlet tanager | A,B |
| Carduelis tristis | American goldfinch | A |

Table 10.

List of mammals observed at Flag Ponds, Calvert County, Maryland, 1990.

| | |
|---|---|
| Sylvilagus floridanus | Eastern cottontail |
| Sciurus carolinensis | Gray squirrel |
| Ondatra zibethicus | Muskrat |
| Vulpes vulpes | Red fox |
| Procyon lotor | Raccoon |
| Mustela vison | Mink |
| Odocoileus virginianus | White-tailed deer |

Attachment A.

# PROPOSAL FOR NATURAL RESOURCES MAPPING AND STUDIES OF FLORISTICS AND PLANT PHYSIOGNOMY AT FLAG PONDS NATURAL AREA CALVERT COUNTY, MARYLAND

John E. Hench, Ph.D.
4313 Wendy Court
Monrovia, Maryland 21770

## GOAL

To acquire natural resources data necessary to objectively assess impacts of development in Flag Ponds Natural Area, Calvert County, Maryland.

## OBJECTIVES

To prepare 1" = 200' scale natural resources plates for Flag Ponds Natural Area including (1) topography with existing development, (2) soils, (3) slope, (4) wetlands, 100 year flood-plain, and major drainage divides, (5) black-and-white leaf-on and leaf-off aerial photography, and (6) plant communities.

To describe the floristics and physiognomy of major plant communities at Flag Ponds Natural Area.

To establish a permanent plot system at Flag Ponds Natural Area.

## BACKGROUND

Flag Ponds Natural Area encompasses 327 acres on the Western Shore of Chesapeake Bay. The site is considered "the most environmentally sensitive, diverse, and unique area in the region (Calvert County Board of Commissioners, 1984:2)." Topographically, the park is separated into two distinct areas: a broad, low lying, actively accreting, sandy cape and a severely eroded and disected upland terrace. A steep cliff, 80 to 100 feet above sea level and oriented in a north-south direction, demarcates a boundary between the two areas. Land to the west of the cliffs drains to St. Leonard's Creek and Patuxtent River whereas land to the east drains directly to Chesapeake Bay. Bathymetry has shown that a large shoal, ranging 200 feet out at the northern end to 1000 feet out at the southern end, is developing off-shore of the southward accreting cape (Calvert County Board of Commissioners, 1984). At present, the shoal is exposed during extremely low tides. Future enlargement of the shoal should result in formation of a new pond east of the existing beach.

Hill (1987) notes that Flag Ponds Natural Area encompasses four major community types: (1) tidal saline bay, (2) interdunal -- including pond, marsh, and swamp, (3) accreting sandy beach, and (4) upland deciduous forest. Two State Endangered species, Star duckweed (*Lemna trisulca*) and Northeastern Beach Tiger-beetle (*Cincindela d. dorsalis*), are known from the site. The former species is a Federal

candidate for Threatened or Endangered status. Shorebirds, osprey (Pandion haliaetus), colonial waterbirds, and waterfowl use Flag Ponds seasonally. Numerous species of forest interior birds -- including Red-shouldered Hawk (Buteo lineatus), Red-eyed Vireo (Vireo olivaceus), and Scarlet Tanager (Piranga olivacea) -- nest in the upland deciduous forest.

A Master Plan for Flag Ponds Natural Area was approved by the Board of County Commissioners, Calvert County, in November, 1984. The document outlines three phases of planned development. Phases I (FY 85,86) and II (FY 87,88,89) include entrance road improvements, security gates, parking, security residence, loop road system, emergency access road to the beach, visitor center with restrooms, fishing pier, bathhouse, boardwalk, and trails. As of autumn 1989, Phases I and II had been largely completed. Additional parking, trails, primitive camping areas, and picnic facilities are planned for Phase III in FY 90 and 91.

## METHODS

### Preparation of Natural Resource Plates

#### Project Grid and Base Map

The Project Consultant (Dr. John E. Hench) will provide Photo Science, Inc., Gaithersburg, Maryland, with 1" = 200' scale topographic maps of Flag Ponds Natural Area, 1" = 1,320' scale soils maps (Matthews, 1971), and a 1" = 2,000' scale U.S. Fish and Wildlife Service National Wetlands Inventory Map for the Cove Point Quadrangle. Photo Science, Inc., will identify Maryland State Plane Grid coordinates on the original map. Coordinates for the project area will be established jointly by Photo Science, Inc., the Project Consultant, and Calvert County staff.

In order to ensure proper registration of all map products, a project grid with a grid interval of 5.0 inches will be set up on a Wild TA2 plotting table. The project grid will be punch registered with a seven hole punch; all subsquent map products will employ a matching set of punch register holes.

The original topographic map will be checked for accuracy by comparing coordinate values on the original map to those on the project grid. Photo Science, Inc., will then add a neat line, map title, scale, and north arrow using scribe-coat plates and produce a composite positive of the base map on 0.004 inch Mylar drafting film. The composite will be sumbitted to the Project Consultant for review and editing.

## Aerial Photography

The Project Consultant will obtain most recent high altitude black-and-white leaf-on and leaf-off aerial photography from Air Photographics, Inc., Martinsburg, West Virginia. Photography will be enlarged to 1" = 200' on 0.004 inch Mylar and used to delineate existing development and plant community boundaries.

## Soils and Wetlands

Appropriate sections of soils and wetlands maps will be enlarged to 1" = 200' and carefully matched to the base map. A composite positive, including neatline, project grid, and registration, will be produced for each on 0.004 inch Mylar. The Project Consultant will review and edit this material.

## Slope, Drainage, and Plant Communities

Photo Science, Inc., will provide the Project Consultant with blank sheets of punch registered Mylar. The Project Consultant will use these sheets to develop interpretive plates for slope, drainage with 100 year floodplain, and plant communities in pencil. Completed tracings will be returned to Photo Science, Inc., for the next production phase.

## Preparation of Descriptive Legends

Legends describing mapped attributes will be designed by Photo Science, Inc., and the Project Consultant. Completed art work will be submitted to Calvert County staff for review and editing.

## Production of Scribe-coat Films

Photo Science, Inc., will transfer information from the pencil tracings to punch registered, stable-base, scribecoat film. Completed scribe-coat films, with the corresponding tracing, will be submitted to the Project Consultant for review and editing.

## Production of Peel-coat Films

To facilitate delineation of broad areas of tone on final map sheets, photosensitive peel-coat films will be produced. The peel-coat sheets are punch registered and exposed using an edited, corrected scribe-coat. After exposure and development, the peel-coat film is laid over the original pencil tracings and selected areas of final map sheets a halftone screen tint will be exposed into the "window" areas. Completed peel-coat films will be submitted to the Project Consultant for review and editing.

Production of Final Positive Map Sheets

Photo Science, Inc., will produce final maps at 1" = 200' on 36 x 44 inch sheets of photosensitive Mylar. Final sheets will include a neat line, Annotated State Plane Grid, and park boundary. Sheets will depict the scribe-coat for each resource attribute and the accompanying peel-coat films. Appropriate legend blocks will be added to each sheet in a non-image area. Security negatives will be produced for each sheet at 1" = 200' scale thereby facilitating production of future copies with increased efficiency and reduced cost. Calvert County will receive all maps and negatives.

Descriptions of Floristics and Physiognomy

The Project Consultant and Field Ecologist (James M. Hill) will jointly develop descriptions of floristics and physiognomy for Flag Ponds Natural Area. A description of the methodology follows.

A Geological Survey 7.5' topographic map and Fish and Wildlife Service National Wetlands Inventory map were used to establish two strata for field sampling. Strata I included areas of the park greater than 25 feet in elevation; Strata II included areas less than 25 feet in elevation. A 1" = 200' scale base map of Flag Ponds Natural Area was then gridded at 500 foot intervals based on the Maryland State Plane Grid. Grid columns were labeled A through L; rows were labeled 1 through 11. The grid yielded 30 points (grid intersections) in Strata I and 25 points in Strata II. Fifteen points were then randomly selected from each strata for field sampling. The following information will be collected at each of the 30 points:

Tree species: The basal area, density, frequency, quadratic average diameter at breast height, and importance value of tree species will be obtained with a method of forest sampling developed by Eichenberger et al. (1982). A Cruise Master 4.9 feet square/acre (two meters square/hectare) amber thin prism will be used for point and plot tallies. Plot radius will be 32.8 feet (10 meters) from the sampling point. Borderline trees will be counted as one half.

Shrub species: All shrub species [woody vegetation less than 21 feet (6.4 meters) tall] present on a 13.2 foot (4 meter) square plot oriented on the southeast corner of the sampling point will be recorded. Shrub species cover will be presented as both absolute and relative frequency.

Herbaceous species: All herbaceous species present on two 3.3 foot (one meter) square plots oriented in the northeast and southwest corners of the shrub plot will be recorded. Herb plots will be surveyed during the spring and again one or more times during the summer. Herbaceous species cover will be presented as both absolute and relative frequency.

Information from the plant survey as well as a Geological Survey 7.5' topographic map, Calvert County soils maps (Matthews 1971), a Fish and Wildlife Service National Wetlands Inventory map, and high altitude black-and-white leaf-on and leaf-off aerial photography will be used to delineate major plant community boundaries.

Permanent Plots

A permanent plot will be jointly established at each sampling point by the Project Consultant and Field Ecologist during the course of the plant survey. Each of the 30 plots will be permanently marked with either metal tags nailed to trees or six foot metal stakes driven into the ground and referenced to the Maryland State Plane Grid.

**SCHEDULE**

| Work Products | Projected Completion |
|---|---|
| Base map, aerial photography, soils map, and wetlands map. | June 1, 1990 |
| Slope map, drainage map with 100 year floodplain, and plant communities map. | July 1, 1990 |
| Descriptions of floristics and physiognomy, permanent plot set up, and final report. | September 30, 1990 |

**BUDGET**

| Task | Project Consultant | Photo Sci., Inc. | Field Ecologist | Calvert County |
|---|---|---|---|---|
| Coordination | $1,000 | | | |
| Mapping | $6,000 | $6,000 | | |
| Floristics & Physiognomy | $3,750 | | $3,750 | |
| Permanent Plots | $ 500 | | $ 500 | |
| Equipment, aerial photos, misc. expenses | | | | $2,500 |

## LITERATURE CITED

Board of County Commissioners, Calvert County, Maryland. 1984. Flag Ponds Natural Area Master Plan. Department of Planning and Zoning. Prince Frederick, Maryland. 23pp.

Hill, James M. 1987. Description of Critical Area Natural Heritage Area 12: Flag Ponds, Calvert County, Maryland. Maryland Department of Natural Resources, Natural Heritage Program. Annapolis. 10 pp. + 18 sheets.

Matthews, E. D. 1971. Soil Survey, Calvert County, Maryland. U.S. Department of Agriculture, Soil Conservation Service. 36pp. + 36 sheets.

# APPENDIX A

Plant Species Composition for the Permanent Plots
Flag Ponds Natural Area, Calvert County, Maryland

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/G-2, 1990.**

---

**Herbaceous species**

Hibiscus moscheutos
Lemna sp.
Lemna trisulca
Phragmites australis

**Woody species**

Acer rubrum

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/G-4, 1990.**

---

**Herbaceous species**

Hibiscus moscheutos
Lemna sp.
Lemna trisulca
Typha angustifolia

**Woody species**

Cephalanthus occidentalis

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/H-3, 1990.**

---

**Herbaceous species**

Hibiscus moschuetos
Lemna trisulca
Typha angustifolia

**Woody species**

none present

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/H-4, 1990.**

---

**Herbaceous species**

Hibiscus moscheutos
Lemna sp.
Lemna trisulca

**Woody species**

Acer rubrum
Fraxinus pennsylvanica
Liquidambar styraciflua

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/I-5, 1990.**

---

**Herbaceous species**

Lemna trisulca

**Woody species**

Acer rubrum
Cornus stolonifera
Fraxinus pennsylvanica
Liquidambar styraciflua

**Flag Ponds Nature Park, Calvert County, Maryland.**
**Plants located on permanent plot # A/I-6, 1990.**

---

**Herbaceous species**

none present

**Woody species**

Acer rubrum
Fraxinus pennsylvanica
Liquidambar styraciflua
Ulmus americana

**Flag Ponds Nature Park, Calvert County, Maryland.**
**Plants located on permanent plot # A/I-7, 1990.**

---

**Herbaceous species**

none present

**Woody species**

Acer rubrum
Fraxinus pennsylvanica
Ilex verticillata
Liquidambar styraciflua
Platanus occidentalis
Ulmus americana

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/J-5, 1990.**

---

**Herbaceous species**

Phragmites australis

**Woody species**

none present

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/J-7, 1990.**

---

**Herbaceous species**

Eupatorium sp.
Hibiscus moscheutos
Lemna trisulca
Typha angustifolia
Typha latifolia

**Woody species**

Acer rubrum
Cephalanthus occidentalis
Fraxinus pennsylvanica
Liquidambar styraciflua
Nyssa sylvatica
Salix nigra
Viburnum prunifolium

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/J-8, 1990.**

---

**Herbaceous species**

Lemna trisulca

**Woody species**

Acer rubrum
Campsis radicans
Fraxinus pennsylvanica
Liquidambar styraciflua
Nyssa sylvatica
Rhus radicans
Smilax rotundifolia

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/K-6, 1990.**

---

**Herbaceous species**

Allium sp.
Galium sp.
Menispermum canadense

**Woody species**

Campsis radicans
Cornus florida
Fraxinus pennsylvanica
Liquidambar styraciflua
Myrica cerifera
Nyssa sylvatica
Parthenocissus quinquifolia
Pinus taeda
Rhus radicans

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/K-7, 1990.**

---

**Herbaceous species**

Lemna minor

**Woody species**

Fraxinus pennsylvanica

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/K-8, 1990.**

---

**Herbaceous species**

Carex sp.
Galium sp.

**Woody species**

Asimina triloba
Fagus grandifolia
Liquidambar styraciflua
Myrica cerifera
Nyssa sylvatica
Pinus rigida
Pinus taeda
Platanus occidentalis
Quercus marilandica
Rhus copallina
Ulmus americana
Vitis sp.

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/K-9, 1990.**

---

**Herbaceous species**

Mitchella repens
Viola sp.

**Woody species**

Diospyros virginiana
Euonymus americanus
Fagus grandifolia
Fraxinus pennsylvanica
Juniperus virginiana
Lindera benzoin
Liquidambar styraciflua
Myrica cerifera
Nyssa sylvatica
Pinus rigida
Pinus taeda
Quercus falcata

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # A/L-9, 1990.**

---

**Herbaceous species**

none present

**Woody species**

none present

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/B-5, 1990.**

---

**Herbaceous species**

Aster sp.
Ceratophyllum demersum
Equisetum sp.
Galium sp.
Impatiens capensis
Podophyllum peltatum
Polygonum persicaria
Ranunculus sp.
Saururus cernuus
Symplocarpus foetidus
Tovara virginiana
Viola sp.

**Woody species**

Acer rubrum
Asimina triloba
Carpinus caroliniana
Cornus florida
Fraxinus pennsylvanica
Ilex opaca
Lindera benzoin
Liquidambar styraciflua
Liriodendron tulipifera
Prunus virginiana
Ulmus americana

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/C-5, 1990.**

---

**Herbaceous species**

Arisaema atrorubens
Arisaema triphyllum
Aster sp.
Desmodium nudiforum
Fragaria virginiana
Galearis spectabilis
Galium circaezans
Podophyllum peltatum
Ranunculus arbortivus
Viola sp.

**Woody species**

Acer rubrum
Asimina triloba
Carpinus caroliniana
Carya glabra
Fagus grandifolia
Ilex opaca
Lindera benzoin
Liquidambar styraciflua
Liriodendron tulipifera
Nyssa sylvatica
Quercus prinus
Viburnum acerifolium

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/C-6, 1990.**

---

**Herbaceous species**

Arisaema sp.
Aster sp.
Caltha palustris
Cryptotaenia canadensis
Impatiens capensis
Ranunculus sp.
Ranunculus arbortivus
Ranunculus septentrionalis
Saururus cernuus
Symplocarpus foetides
Tovara virginiana
Viola sp.

**Woody species**

Acer rubrum
Asimina triloba
Carpinus caroliniana
Fagus grandifolia
Fraxinus pennsylvanica
Lindera benzoin
Liquidambar styraciflua
Nyssa sylvatica
Rhus radicans
Smilax rotundifolia

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/E-5, 1990.**

---

**Herbaceous species**

Mitchella repens

**Woody species**

Acer rubrum
Amelanchior sp.
Carpinus caroliniana
Cornus florida
Fagus grandifolia
Ilex opaca
Liquidambar styraciflua
Liriodendron tulipifera
Nyssa sylvatica
Pinus virginiana
Prunus virginiana
Quercus falcata
Viburnum acerifolium

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/E-6, 1990.**

---

**Herbaceous species**

Alium sp.
Arisaema sp.
Aster sp.
Desmodium nudiforum
Podophyllum peltatum
Polystichum acrostichoides
Viola conspera

**Woody species**

Acer rubrum
Asimina triloba
Carpinus caroliniana
Cornus florida
Fagus grandifolia
Ilex opaca
Liquidambar styraciflua
Liriodendron tulipifera
Prunus virginiana
Quercus rubra
Viburnum acerifolium

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/F-3, 1990.**

---

**Herbaceous species**

Arisaema sp.
Aster sp.
Dentaria diphylla
Galium sp.
Podophyllum peltatum
Polystichum acrostichoides
Ranunculus arbortivus
Viola rotundifolia

**Woody species**

Asimina triloba
Carpinus caroliniana
Cornus florida
Fagus grandifolia
Fraxinus pennsylvanica
Liquidambar styraciflua
Liriodendron tulipifera
Prunus virginiana
Quercus rubra

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/F-4, 1990.**

---

**Herbaceous species**

Arisaema sp.
Aster sp.
Athyrium platynueron
Dentaria diphylla
Galium sp.
Mitchella repens
Oxalis sp.

**Woody species**

Acer rubrum
Asimina triloba
Carpinus caroliniana
Carya glabra
Cornus florida
Fagus grandifolia
Liquidambar styraciflua
Liriodendron tulipifera
Prunus virginiana
Quercus falcata
Quercus rubra
Viburnum acerifolium

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/F-5, 1990.**

---

**Herbaceous species**

Mitchella repens

**Woody species**

Acer rubrum
Asimina triloba
Carya glabra
Cornus florida
Fagus grandifolia
Ilex opaca
Liquidambar styraciflua
Liriodendron tulipifera
Pinus virginiana
Prunus virginiana
Quercus alba
Quercus falcata
Quercus prinus
Quercus rubra
Sassafrass albidum
Smilax rotundifolia

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/H-7, 1990.**

---

**Herbaceous species**

Carex sp.
Galium circaezans
Polystichum acrostichoides

**Woody species**

Acer rubrum
Asimina triloba
Carpinus caroliniana
Carya glabra
Cornus florida
Fagus grandifolia
Ilex opaca
Kalmia latifolia
Liquidambar styraciflua
Liriodendron tulipifera
Pinus taeda
Prunus virginiana
Quercus alba
Quercus prinus
Sassafrass albidum
Viburnum prunifolium

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/H-8, 1990.**

---

**Herbaceous species**

Viola sp.

**Woody species**

Acer rubrum
Amelanchior sp.
Carya glabra
Cornus florida
Ilex opaca
Liquidambar styraciflua
Liriodendron tulipifera
Parthenocissus quinquifolia
Prunus virginiana
Quercus falcata
Rhus radicans
Sassafrass albidum
Smilax rotundifolia
Viburnum acerifolium

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/H-9, 1990.**

---

**Herbaceous species**

Lycopodium obscurum
Ranunculus sp.

**Woody species**

Acer rubrum
Carpinus caroliniana
Carya sp.
Cornus florida
Euonymus americanus
Ilex opaca
Liquidambar styraciflua
Liriodendron tulipifera
Ostrya virginiana
Pinus taeda
Pinus virginiana
Prunus virginiana
Quercus sp.
Robinia pseudo-acacia
Sassafrass albidum
Smilax rotundifolia
Vaccinium corumbosum

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/H-10, 1990.**

---

**Herbaceous species**

Caltha palustris
Eupatorium sp.

**Woody species**

Acer rubrum
Asimina triloba
Cornus florida
Diospyros virginiana
Ilex opaca
Liquidambar styraciflua
Liriodendron tulipifera
Pinus taeda
Pinus virginiana
Prunus virginiana
Smilax rotundifolia

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/I-8, 1990.**

---

**Herbaceous species**

Arisaema sp.
Dentaria diphylla
Galium sp.
Galium circaezans
Podophyllum peltatum

**Woody species**

Asimina triloba
Cornus florida
Ilex opaca
Lindera benzoin
Liquidambar styraciflua
Liriodendron tulipifera
Parthenocissus quinquifolia
Pinus taeda
Prunus virginiana
Smilax rotundifolia

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/I-10, 1990.**

---

**Herbaceous species**

Allium sp.
Aster sp.
Fragaria virginiana
Galium circaezans
Viola sp.
Viola conspera

**Woody species**

Carpinus caroliniana
Cornus florida
Ilex opaca
Lindera benzoin
Liquidambar styraciflua
Liriodendron tulipifera
Prunus virginiana

**Flag Ponds Natural Area, Calvert County, Maryland.**
**Plants located on permanent plot # B/J-10, 1990.**

---

**Herbaceous species**

Aster sp.
Aster sagittifolius
Mitchella repens
Polystichum acrostichoides
Viola sp.
Viola conspera

**Woody species**

Acer rubrum
Carpinus caroliniana
Carya glabra
Cornus florida
Ilex opaca
Liquidambar styraciflua
Liriodendron tulipifera
Prunus virginiana
Quercus rubra